

## Ascidians collected in the Weddell Sea by the RV "Polarstern" (EPOS cruise leg 3)

by Claude MONNIOT and Françoise MONNIOT

**Abstract.** — Samples collected with several devices in the Weddell Sea contained 36 ascidian species. Four new species are described. The anatomy and distribution of the other species are commented upon. This antarctic ascidian fauna is compared with previous results from the Antarctic Peninsula, the Ross Sea and subantarctic areas. Affinities with the deep sea fauna are considered.

**Résumé.** — *Ascidies récoltées en mer de Weddell par le RV « Polarstern » (EPOS cruise leg 3).* Des échantillons récoltés par plusieurs engins dans la mer de Weddell contenaient 36 espèces d'ascidies. Quatre espèces nouvelles sont décrites. La répartition des autres espèces est commentée. Cette faune antarctique est comparée à des données précédentes provenant de la Péninsule Antarctique, de la mer de Ross et de régions subantarctiques. Les affinités avec la faune profonde sont envisagées.

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### INTRODUCTION

The Antarctic continent is indented by two large seas, the Ross and Weddell Seas, which both allow collections beyond the 70th parallel. For ascidians, the Ross Sea is the best known with 36 species recorded at depths less than 1000 m (MONNIOT and MONNIOT, 1983). In addition, there are three bathyal or abyssal species : *Culeolus antarcticus*, *Bathyoncus mirabilis*, and *Pyura squamata*. In contrast, only eleven shallow species and one abyssal species (*Boltenia pilosa*) have been recorded in the Weddell Sea.

The ascidian fauna of the pacific area of the Antarctic Ocean is totally unknown for ascidians. Nine species from the Peter I Island were identified by MILLAR (1968), five or seven of them are also known from the Weddell Sea.

The EPOS 3 cruise provided an opportunity to recollect all the species already known from the Weddell Sea at less than 1000 m depth and increase to 36 the list of ascidian species known from the Weddell Sea, including all the previously known forms and four new species.

The animal collection was made using two different kinds of devices which did not provide equivalent ecological indications. All informations about the stations : maps, hydrological, physical, and chemical data can be found in ARNTZ *et al.* (1990).

The collections made with towed gears (Agassiz trawl AGT, bottom trawl GSN, and semipelagic or benthopelagic trawl BPN) have provided most of the specimens. They are not quantitative devices as revealed by repeated sampling at the same station, even if we take into account a patchy distribution. However it is possible to glean from the results some information about ascidian distribution.

The multi-box-corer, comprising 9 cores of 0.024 m<sup>2</sup> each, was used during this cruise. Excepted for two deep samples (1950 and 2037 m), ascidians were collected everywhere. For a total surface of 2.25 m<sup>2</sup>, 51 specimens, including 16 adults, were collected.

Among the 36 species found, 23 are common to the Weddell and Ross Seas, 21 have been recorded from the Indian part of the Antarctic Ocean, and 23 from the eastern coast of the Antarctic Peninsula.

The large homogeneity of the antarctic fauna was emphasized by MONNIOT and MONNIOT (1983) and is clearly confirmed here.

The Weddell Sea ascidian fauna, with 36 species is much poorer than that of the Antarctic Peninsula fauna (59 species). The missing species are mainly polyclinids and polycitorids (colonial ascidians) which generally live at depths less than 100 m. These depths cannot be sampled in the Weddell Sea as they remain permanently under the ice-shelf.

*Agnezia arnaudi*, present in this collection, was not known previously from the antarctic continental platform, having been described from the Kerguelen Islands and reported also at South Georgia. However, it may have been previously collected in the Antarctic, but identified under the name of *Agnesia glacata* by KOTT (1969 or 1971) or by MILLAR (1960 or 1968).

Among the four new species described here, two may be considered as allied to the deep sea fauna.

*Corynascidia cubare* n. sp. belongs to a genus exclusively bathyal or abyssal which is already known to have a representative on the antarctic slope : *C. suhmi*.

The genus *Adagnesia* has at the same time littoral species inhabiting subantarctic and antiboreal areas (Tierra del Fuego, South Australia, New Zealand and Macquarie Island), as well as New Caledonia and Japan, and four abyssal species in the Atlantic and South-eastern Pacific Oceans. The presence of one species of *Adagnesia weddelli* n. sp. on the Antarctic continental shelf in the Weddell Sea is unexceptional if we consider that the Agneziidae family is abundant and diversified only in the antiboreal and abyssal areas.

*Cnemidocarpa eposi* n. sp. also belongs to a genus well diversified in the antarctic and subantarctic areas (seven known species). The genus probably has other species in the Ross Sea, known only by isolated or damaged specimens.

#### ECOLOGICAL REMARKS

##### Trawl collections

The series of trawl samples from the Halley Bay transect contained 31 species, five of them having bathyal or abyssal characteristics, that is to say the main part of the species inhabiting the Weddell Sea. This transect is characterized by the existence of a deep basin at 700 m depth, near the shore, separated by a "ridge", at 300 m depth, from a 70 km wide shelf with an

average depth of 400 m (with a small depression down to 450 m); then begins the continental slope on which sampling was undertaken down to 2000 m depth. The edge of the shelf is located at 100 km from the shore. The hydrological features of the region have been studied by ROHARDT *et al.* (1990) and РАБИТ and BOLDRIN (1990). They demonstrate the existence in both basins of a warmer water mass, with an increased salinity and with a slight deficit in oxygen. Along the slope both the temperature and dissolved oxygen decrease rapidly.

The ascidians are present along the three parts of the transect (18 species in the littoral basin, 16 on the shelf and 18 on the slope). Among the 12 most abundant species, *Polysyncrator trivolutum* (colonial) is present only in the littoral basin and on the shelf, *Synoicum adareanum* (colonial) has been found only on the shelf, and *Aplidium meridianum* (colonial) inhabits only the shelf and the upper part of the slope. The solitary species are distributed in all three areas, except that *Bathypora splendens* is absent from the littoral basin. The abundance of *Caenagnesia bocki* in the littoral basin is also noteworthy (110 specimens in a subsample at st. 226 GSN 5). This species was collected on the shelf with a corer (7 specimens on 0.160 m<sup>2</sup>), but not with the trawls, probably indicating a patchy distribution.

It appears that, in this area, colonial ascidians are limited to the shallowest bottoms, while the solitary forms are more numerous on the upper part of the slope. The maximum temperature and the minimum oxygen content do not seem to affect the ascidian distribution.

The Kapp Norvegia transect, following an angular line determined by the local topography, is not so rich in ascidians as the Halley Bay transect (21 species only). The ascidians are less diversified near the shore than on the top of the slope, and both solitary and colonial species are distributed similarly.

The Vestkapp transect has fewer stations (5 AGT) and obtained only 11 species.

ARNAUD *et al.* (1990) based on shipboard analyses reported the distributions of the main zoological groups from AGT and BPN samples. In each sample, the groups were recorded in one of five categories: absent, very rare, rare, rather common, and very common. The published data do not fit the true distribution of ascidians along the transects, since the areas where the ascidians are most varied and numerous do not correspond to the table given by ARNAUD *et al.* For example, at station 126 AGT 2 the ascidians are reported as "very rare", whereas the other devices have collected 150 specimens of 11 species at the same station.

The AGT samples which are the richest in ascidians in areas where ascidians are considered as "common" (st. 230 AGT 5, with 32 specimens in 5 species; 232 AGT 7 with 15 specimens of 6 species, and 273 AGT 19 with 24 specimens of 5 species) are not so rich as other stations where ascidians are considered as only "rather common" (st. 258 AGT 8, 34 specimens of 11 species, 271 AGT 15, 25 specimens of 10 species, and 273 AGT 17, 31 specimens of 8 species).

#### **Multi-box-corer quantitative collections**

We have noticed the abundance of very small specimens of large Molgulidae or Polyclinidae species, often at an oozoid stage or in colonies of only 2 or 3 zooids. The presence of young Molgulidae, a family living at the sediment surface, is to be expected. The adult colonies of Polyclinidae in this area are generally settled on pebbles or shells and it is possible that the core samples represent young colonies "lost" on the soft sediment.

Among the 6 adult species collected by corers, the species *Synoicum polygyna* has not been taken by any of the other devices. Four further species (*Adagnesia weddelli*, *Dicarpa tricostata*, *Styela glans*, and *Pareugyrioides arnbackae*) were rarely found in trawls. One species only (*Caenagnesia bocki*) is abundant in trawls. This demonstrates the existence of an ascidian fauna living on sedimentary bottoms which is not well sampled by trawls. Four of the six species (*Synoicum polygyna*, *Dicarpa tricostata*, *Styela glans*, and *Pareugyrioides arnbackae*) have been collected with a grab under the ice pack, on the bottom of McMurdo Bay in the Ross Sea (MONNIOT and MONNIOT, 1980). This fauna appears to be very homogeneous around the Antarctic Continent.

#### REMARKS ABOUT SPECIES

##### *Aplidium cyaneum* Monniot and Monniot, 1983

MATERIAL : Halley Bay transect, st. 230 ; Kapp Norvegia transect, st. 291.

This species is wide spread in the Antarctic Ocean and the deep subantarctic areas.

##### *Aplidium meridianum* (Sluiter, 1906)

MATERIAL : Halley Bay transect, st. 230, 235, 241 and 258 ; Vestkapp area, st. 269, 270, 272 and 273 ; Kapp Norvegia transect, st. 224, 274, 281, 284, 291 and 293.

This species forms thick cushions of several centimetres diameter, with the surface incrustated with sand. The basis of the colony is rarely raised in a very short and wide peduncle, but is generally covered by very numerous sandy hairs anchoring the animal into the sediment. The zooids are arranged in linear double rows, not very regular, opening by a large cloacal aperture at the top of the colonies. The general consistency of the colonies is very soft, as the internal tunic is slimy.

All characters correspond well to the previous descriptions (MONNIOT F., 1978, type revision ; MONNIOT and GAILL, 1978 ; MONNIOT and MONNIOT, 1983). *A. meridianum* is a eurybathic periantarctic species.

##### *Aplidium millari* n. sp.

(Fig. 1)

MATERIAL : Halley Bay transect, st. 235 GSN 7, 75°09.1'S-27°34.7'W, 407 m : 1 specimen. Holotype : MNHN A1 APL.B 295.

There is only one damaged colony in a soft cushion 4.5 cm in width. The surface of the colony is covered with sand but the internal part is glassy, very soft, slimy, coloured pink in formalin. It was probably red when living. The zooids are arranged in circular systems. The oral siphon has six foliated lobes. The cloacal aperture is elongated as a short tube of which the dorsal part extends in a languet ending in three teeth (fig. 1, A, B).

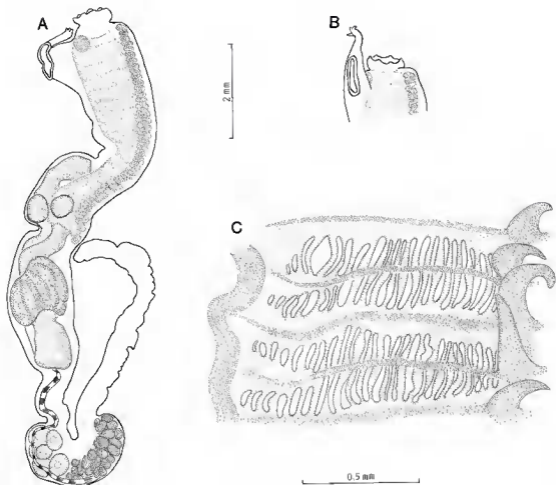


FIG. 1. — *Aplidium millari* n. sp. : A, zooid ; B, anterior part of another zooid ; C, detail of the branchial sac.

From the outside of the thorax, the number of stigmata rows seems to be 14 to 15. When the thorax is opened along the endostyle, the stigmata rows appear double, regularly cut by parastigmatic vessels (fig. 1, C). The rapheal languets are of the same size on the primary and secondary transverse vessels (fig. 1, C).

The abdomen is relatively short. The esophagus is wide and short. The stomach is asymmetrical as in the genus *Synoicum*, but with incomplete and not well marked oblique folds (fig. 1, A), four on one side and two or three on the opposite side. The postabdomen is elongated. The ovary is just below the abdomen, followed by a series of testis follicles. The posterior part of the postabdomen does not contain gonads (fig. 1, A). In this colony, the tadpole larvae incubated in the posterior part of the cloacal cavity are not fully mature.

This species has zooids similar to those of *A. cyaneum*, with parastigmatic vessels doubling the stigmata rows, but more numerous, and a tridentated cloacal languet above a tubular siphon. The shape of the stomach is similar. The shape of the colony is very different here, in the form of a flat cushion, with many circular systems instead of one. The colour in formalin is an intense pink, whereas *A. cyaneum* is blue, sometimes faded but never red. The species is dedicated to Dr. R. H. MILLAR.

#### ***Synoicum adareanum* (Herdman, 1902)**

SYNONYMY : See MONNIOT and MONNIOT, 1983 : 31.

MATERIAL : Halley Bay transect, st. 230, 235, 241 and 256 ; Vestkapp area, st. 270 and 273 ; Kapp Norvegia transect, st. 224 and 284.

This species may have several "heads" arising from a common base. Each element is almost cylindrical with a stout peduncle lightly incrustated with sediment, the test being leathery and wrinkled ; the zooids open at the top of the peduncle in an enlarged hemispherical head. They form circular systems in rosettes. The zooids are very large, slightly visible through the test which is more transparent at the top of the colonies where it is less incrustated with sand. The postabdomens are very long, extending to the basis of the peduncle. The species is very common, periantarctic.

#### ***Synoicum polygyna* Monniot and Monniot, 1980**

MATERIAL : Kapp Norvegia transect, st. 224.

The colonies are characteristic, entirely incrustated with sand. The upper part of each colony, containing the thoraces, is cylindrical, with a central common cloacal aperture at the top. The basal part is divided into several "roots", each containing the postabdomen of one zooid. The "roots" are covered with sandy hairs along their sides. The species is easily identified by its external appearance but also by the long postabdomen containing successive ovaries intercalated between series of testis lobes. The previous collections of this species were made in the McMurdo Bay and the Weddell Sea.

#### ***Polysyncraton trivolutum* (Millar, 1960)**

SYNONYMY : See MONNIOT and MONNIOT, 1983 : 43.

MATERIAL : Halley Bay transect, st. 226, 229, 230, 235 and 241 ; Vestkapp area, st. 271, 272 and 273 ; Kapp Norvegia transect, st. 274, 281, 284 and 289.

The species is widely distributed in the antarctic and subantarctic areas.

***Ciona antarctica* Hartmeyer, 1911**

*Ciona antarctica* Hartmeyer, 1911 : 471, pl. 52, fig. 5 — Wilhelm II Coast ; MONNIOT & MONNIOT, 1983 : 47, fig. 9A-B — West of Antarctic Peninsula.

MATERIAL : Halley Bay transect, st. 230.

This species seems to be rare, the present specimen being only the seventh collected. It was raised above a gravel bottom, anchored by a bush of rhizoids agglomerating coarse sand grains. The test is naked, soft and transparent. Without tunic the body measures 8 cm.

The cloacal siphon neatly overpasses the oral siphon. Both are lobed, but the rim is torn. There are no pigment spots on the apertures. The musculature consists of seven muscular bundles on each side. The tentacles are not numerous, about twenty, located very anteriorly in the oral siphon ; their distance from the edge of the siphon is 1 to 1.5 mm and 7 mm from the peripharyngeal groove. They are short, and irregularly spaced. The peripharyngeal groove has two thick rims, making a circle, without a dorsal V indentation. The nerve ganglion is circular, close to the protruding ciliated tubercle which lacks a well defined opening. The dorsal lamina is composed of very long papillae (up to 5 mm). The branchial sac has no peculiarities. There is a large endostylar appendix protruding under the branchial sac. We have seen with certainty only the right pharyngeal endostylar hole, located near the endostylar appendix. It is hidden in a fold of the retropharyngeal band. According to HOSHINO and NISHIKAWA (1985), *C. antarctica* is allied to *C. intestinalis*. The left side of the branchial sac is damaged.

The anus has numerous rolled lobes. The oviduct and sperm duct open together at the level of the anus. There is no pigment spot. In contrast to the drawing that we published in 1983, the sperm duct seems to have multiple openings. The presence of tissular masses around the digestive tract is confirmed. They constitute the most characteristic feature of this species. MONNIOT and MONNIOT (1991a) have described similar organs in a bathyal Ascidiidae collected in New Caledonia *Fimbrora calsubia*, a macrophagous species looking like a sea anemona. No interpretation of this organ has been proposed. A similar tissue is also present in the genus *Diazona*.

***Tylobranchion speciosum* Herdman, 1886**

MATERIAL : 47°W transect, Signy Island, st. 217 ; Halley Bay transect, st. 229.

This species is present throughout in the Subantarctic and Antarctic Ocean. It is scarce in this collection, but in other areas it is generally encountered in shallow depths.

***Corella eumyota* Traustedt, 1882**

MATERIAL : Vestkapp area, st. 271.

*C. eumyota* is the most widely distributed ascidian in the Antarctic Ocean. It has been recorded from off South America, South Africa and Namibia (TURON, 1988), around St Paul

and Amsterdam Islands in the Indian Ocean, off South Australia and New Zealand. During the EPOS cruise, the species was collected only once, which is rather surprising considering its large bathymetric distribution.

***Corynascidia cubare* n. sp.**

(Fig. 2 A)

**MATERIAL :** Halley Bay transect, st. 241 AGT 8, 75°07.1'S-27°59.5'W, 457-462 m : 1 specimen. Holotype MNHN : P3 COR.B4.

The specimen measuring 6 cm was attached by the postero-ventral right side (under the gut). The oral aperture is terminal, the cloacal aperture on the side. The test is thin, naked, with some soft papillae. The fixation surface has some short hairs, but at its periphery the rhizoids are thick, irregularly ramified, reaching 2 mm in length. The apertures are sessile without any ornament.

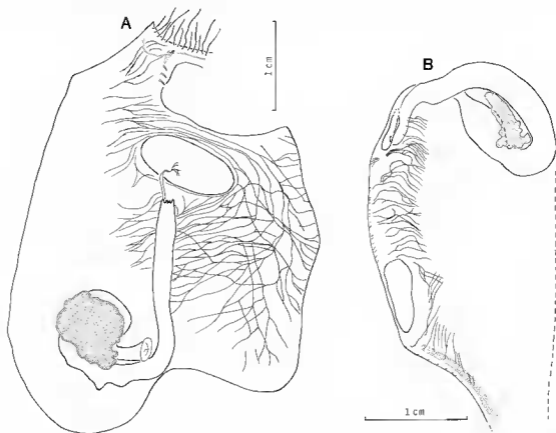


FIG. 2. — A, *Corynascidia cubare* n. sp. cut along the ventral line ; B, *Corynascidia submi* Herdman, 1882, left side of the body.



The animal, removed from the test, lacks a part of the left anterior side of the body. The body wall is thin, the musculature weak and mostly distributed on the left side (fig. 2, A). It slightly extends on the right side between the siphons and under the rectum.

The oral tentacles are located near the edge of the oral aperture, on a ring of muscles. There are about 30, more widely spaced dorsally than ventrally. They are long, thread-like, in three size groups. The peripharyngeal groove is linked by two wide rims, rather widely separated. They do not curve on the dorsal line but make a U on the right side of the ciliated tubercle. This form may be abnormal. The ciliated tubercle is large, protruding, C-shaped and anteriorly opened. The dorsal lamina begins as a sheet above the nervous ganglion and is divided more posteriorly into sharp, long languets. The dorsal lamina is attached to the rectum and, on the left side, extends beyond the esophagus entrance.

The branchial sac is irregular. It extends over a web of large, transverse and rather regular vessels, linked to each other by large longitudinal vessels, external to the branchial sac, but without correlation with the internal system of longitudinal vessels. The spiral stigmata make two or three turns. They are wide, with angles due to the internal parastigmatic vessels distributed as star rays. They have the general appearance of a spider's web. The transverse vessels carry long papillae which may be finger-like, T-shaped or with branches of variable length, sometimes joined by internal thin longitudinal vessels. There is no relationships between the stigmatic spirals and the papillae (for example we counted 18 papillae for 11 stigmata). There are numerous examples of division of the stigmata rows accompanied with the formation of papillae on the parastigmatic vessels.

The digestive tract (fig. 2, A) occupies the posterior quarter of the right side of the body. The esophagus is horizontal; the stomach wall, without ornaments, has an ill-defined outline and gradually leads into the intestine. The isodiametric rectum is attached to the body wall and the dorsal lamina. It opens near the cloacal aperture in a lobed anus.

The gonads are inactive and form an indistinct mass, almost entirely covered with the intestinal loop. Even after staining, the male and female parts cannot be distinguished. We have not seen the gonoducts.

Under the dorsal lamina, at the level of the anus, an appendix ends in filaments. This structure looks like that described in *Corynascidia alata* (MONNIOT and MONNIOT, 1991b) from the neocaledonian slope. The function of this structure is not known. In *C. alata* it contains muscles and seems to be lined with test. In *C. cubare* it has not been possible to verify this point.

*C. cubare* is the only *Corynascidia* possessing a true musculature on the left side of the body, arranged, as in other Corellidae or Ascidiidae, in a dorsal area between the siphons and in anastomosed fibers on the side opposite to the fixation surface. The other *Corynascidia* species able to live lying on a side, *C. translucida* (Monniot C., 1969) from the north-east Atlantic, has only a dorsal muscular area slightly displaced toward the left side. All other species in this genus have only medio-dorsal muscles.

The new species is rather allied to *C. alata* which differs in having a plicated stomach and a gonad not spread into the whole intestinal loop.

*C. suhmi* Herdman, 1882 is also recorded from the Antarctic Ocean. To compare this species in details with the species from the Weddell Sea, we reexamined some specimens of *C. suhmi*; those described by KOTT (1969) and MILLAR (1988) from the southern hemisphere, and those described by HARTMEYER (1924) from the Labrador basin. We have established some

differences with the previous descriptions and ascertained that the North Atlantic specimens correspond well to another species : *C. hartmeyer* nom. nov. (see below).

***Corynascidia submi* Herdman, 1882**

(Fig. 2, B)

**MATERIAL :** Specimens described by KOTT (1969) and MILLAR (1988). Description based on the specimen st. 564 Eltanin (54°17'S-21°25'W, 5190 m).

The whole pedunculate animal measures 11 cm in length. The body itself is about 5 cm long and 3 cm wide. The peduncle is 5 mm in diameter and ends in a thickening anchoring the ascidian on the substrate. The test is naked, smooth, thin and transparent. The cloacal aperture is at the opposite extreme to the peduncle, while the oral aperture is mid-way between the two.

The body is rather damaged but possesses a clear musculature (fig. 2, B) in two latero-dorsal bundles, symmetrical on each side. The muscles are mostly developed between the siphons. We have not seen any muscles posterior to the cloacal siphon of which the posterior edge is missing. Anteriorly to the cloacal aperture, the muscles join together in a large muscle neatly interrupted along the dorsal axis of the body. No muscles cross this axis, all of them being abruptly interrupted.

The oral aperture is wide, the cloacal one smaller. The oral tentacles are numerous (more than 200), very long (5 to 8 mm), and arranged in several circles. Their bases are joined. Smaller tentacles occur between these large ones, but were not counted. The peripharyngeal groove and ciliated tubercle have not been observed. They are probably hidden under the tentacles. The bridles which represent the branchial tissue are inserted under the tentacles. The endostyle runs toward the peduncle where the branchial sac seems to penetrate. The dorsal lamina is made of large languets. The antero-posterior axis of the branchial sac is perpendicular to the body axis. The branchial structure is badly preserved. Only the transverse vessels and the longitudinal vessels remain, the latter not often being interrupted. There are few T-shaped papillae and most of the meshes have no ciliated stigmata. In some parts, some bridles suggest that the structure might have been in spirals, but it is not possible to count the whorls, nor to evaluate the ratio between the spiral number and the vessel number.

The gut is located in the upper part of the body, far from the peduncle. It makes a simple loop, slightly on the right side. The stomach is ovoid and leads to the intestine via a small narrowing. The intestine ends in a simple anus, attached to the dorsal lamina. The gonad is located inside the intestinal loop and the gonoducts accompany the rectum. In this specimen the gonad is poorly developed, but in others the gonoducts are full of gametes.

**REMARKS**

This specimen shows some differences from KOTT's description of this same animal. We have not found muscles posterior to the cloacal aperture. There are more than 200 oral tentacles compared with KOTT's reported 60. The gut does not have such a clearly defined stomach and the long rectum ends in the cloacal siphon. KOTT's drawing (1969, fig. 115) is

more semi-schematic than real. It does not give the true dimension of the branchial sac which extends into the anterior part of the peduncle. The original shape is probably closer to HARTMEYER's drawing (1911, pl. 60 fig. 5). Two other drawings published by KOTT were made after HERDMAN (1882, fig. 113) and VAN NAME, (1945, fig. 114). The origin of this last drawing is problematic as VAN NAME did not examine this species and has not given the origin of his drawing.

*Corynascidia hartmeyer* nom. nov.

(Fig. 3)

*Corynascidia submi* : HARTMEYER, 1924 : 19. Type specimen in the Zoologisk Museum Kopenhagen — Danish Ingolf Expedition st.36 : 61°50'N-56°27'W, 2625 m.

The specimen that we have chosen as a type is probably the animal on which HARTMEYER based his description. It measures 8 cm in length. The body is ovoid, 1 cm wide in the anterior part, and progressively narrows toward the peduncle which has a diameter of 2 or 3 mm. The animal was attached by a widened part adhering to the substrate. Close to the basis of the peduncle are two test extensions ending in stout short papillae. The test is thin, naked and transparent. The gut occupies the upper part of the body where the cloacal siphon opens, slightly to one side. The oral aperture is 1.8 cm from the cloacal siphon and closer to the peduncle.

The branchial sac is about 4 cm long, so that the oral siphon opens in the middle of the branchial sac. The peduncle contains a body wall extension down to its basis. The apertures do not have distinct lobes. The muscles are present only on the dorsal side of the body. They are restricted to a few transverse fibers and a bundle located close to the cloacal aperture (fig. 3, A, B). The circular musculature is weak around the apertures. There are no muscles inside the peduncle and its stiffness is probably maintained by blood pressure.

The oral tentacles are long, 3 to 5 mm, and extend through the oral aperture. They are thin, number more than a hundred, and are arranged on a crest. They have several orders of slightly different sizes. The peripharyngeal groove has only one protruding rim. It makes a deep V against the endostyle (fig. 3, C). Dorsally it deviates from the tentacular circle and becomes higher, almost making a mediadorsal papilla (fig. 3, C). The space between the tentacles and the peripharyngeal groove carries small papillae. The neural ganglion is small, clearly displaced on the left side. The ciliated tubercle is cryptic inside the body wall, opening by a small irregular hole. The endostyle is short, straight, running from the cloacal siphon to the basis of the peduncle. It then passes to the retropharyngeal band, longer than itself, at the bottom of the branchial sac, ending at the esophagus entrance, in the anterior part of the body. The dorsal lamina begins at some distance from the ciliated tubercle. It forms a low lamina in the middle of an unperforated band.

The branchial sac is twice as wide as long. The clearly visible transverse vessels are parallel to the long axis of the animal. We counted 22 stigmata rows. The branchial papillae arise on the transverse vessels and are relatively thin and tall. Most of them are T-shaped, but some unite to make thread-like sinuses. The stigmata are large and arranged in spirals. The branchial tissue is reduced to thin strips between the stigmata. The stigmata are covered with a web of

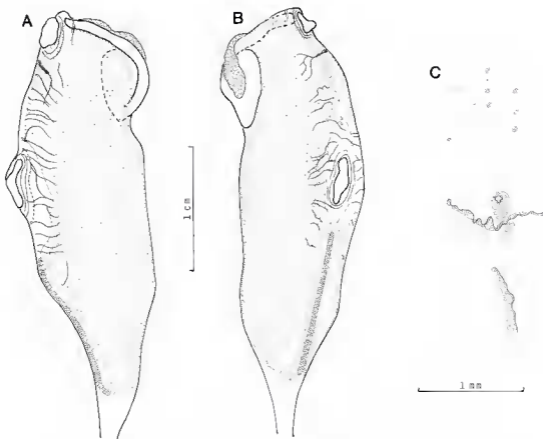


FIG. 3. — *Corynascidia hartmeyeri* nom. nov. : A and B, left and right sides ; C, neural area.

very thin parastigmatic vessels. The whole structure looks like a spider's web. The stigmata do not seem to bear cilia. They are less numerous than the papillae, about three papillae per two stigmata.

The digestive tract is located under the branchial sac, slightly displaced on the right side. It makes a narrow loop at the bottom of the body. We have not been able to differentiate between the smooth walled stomach and the intestine. Both are filled with sediment. The rectum is long, attached to the dorsal lamina and opening in a large anus without lobes. The massive gonad occupies the center of the digestive loop. It has not been possible to distinguish the testis from the ovary. The oviduct is filled with eggs and accompanies the rectum.

This species differs from *Corynascidia suhmi* in the rapheal structure with two lines of triangular languets and in the number of longitudinal vessels (according to HERDMAN's description). In *C. suhmi* there are a little more than two vessels for one stigmata.

*Agnezia arnaudi* (Monniot and Monniot, 1974)

MATERIAL : Halley Bay transect, st. 226 ; Vestkapp area, st. 271.

This species was recorded only in Kerguelen and South Shetland Islands. It is well characterized by two lines of infundibula between two transverse vessels. The sperm duct opens a little behind the anus, while the oviduct passes under the stomach and opens posteriorly in the cloacal cavity on the right side, where the embryos are incubated. One of the samples from the Weddell Sea has a full oviduct, but we have not seen incubated larvae.

*Agnezia biscoei* (Monniot and Monniot, 1983)

MATERIAL : Kapp Norvegia transect, st. 224.

Only one damaged specimen is present in the collection. The species is characterized by only one infundibulum between two transverse vessels. It has not been possible to verify the location of the genital ducts. *A. biscoei* seems to be strictly limited to the antarctic continental shelf.

*Adagnesia weddelli* n. sp.

(Fig. 4)

MATERIAL : Halley Bay transect, st. 241 MG 7, 75°05.5'S-28°01.0'W, 462 m : 1 specimen (holotype MNHN P3 ADA 25); st. 252 AGT 12, 74°28.2'S-29°41.9'W, 1153-1223 m : 1 specimen.

This species is spherical, 1 cm in diameter, covered posteriorly or on 2/3 of its surface by thin hairs agglomerating sediment. The test, thin and transparent, is partially covered with very small sand grains. Both siphons are protruding, close to each other (3 mm), somewhat wrinkled and less encrusted than the remainder of the body.

The musculature is well developed (fig. 4, A). It is constituted mostly of two areas of 25 to 30 radial parallel bands, issuing from both siphons and covering 2/3 of the body. The circular muscles are restricted to the siphons. On the left side of the body there is a ventral musculature which crosses the endostyle in the posterior part only. Dorsally, under the cloacal siphon, there are transverse muscles. Under the rectum, this structure is divided into a left and right hand part. One muscle, not included in the dorsal field, crosses the intestine a little anteriorly to the esophagus entrance (fig. 4, A, D). The general aspect of the muscles is reminiscent of that of *Adagnesia schmitti*.

The long oral siphon is closed by a large velum inserted before the tentacular circle. There are 64 tentacles in five orders of size regularly alternated, the largest being the most posterior ones. The peripharyngeal groove has two well separated and protruding rims. The ciliated tubercle opens in a simple hole posteriorly to the anterior rim. The posterior rim is elevated,

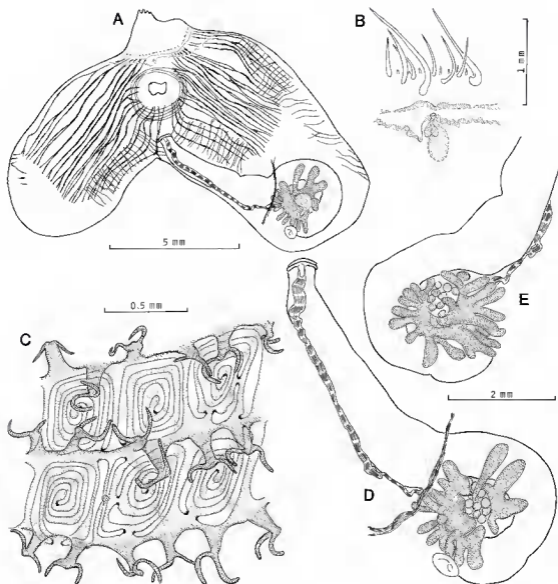


FIG. 4. — *Adagnesia weddelli* n. sp. : A, specimen cut along the ventral side ; B, neural area ; C, branchial sac ; D and E, internal and external sides of the digestive tract.

its edge undulated with a small languet under the ciliated tubercle (fig. 4, B). The dorsal lamina is made of large triangular languets. It is attached to the rectum and this region is unperforated.

The branchial sac has 16 horizontal infundibula rows separated by 15 transverse vessels which have flat T-shaped papillae with large lateral extensions (fig. 4, C). We counted 15 infundibula in half a row and about 20 papillae. The most regular infundibula are made of three stigmatic turns. Everywhere in the branchial sac, these stigmata may be divided; in the ventral part, most of the secondarily divided stigmata make two infundibula, rarely well formed, and generally incomplete. Sometimes a new transverse vessel begins with papillae. It is not clear whether or not subsequent development results in new double rows of infundibula.

The esophagus entrance is very posterior, so the gut is entirely on the left side. The esophagus is short, the stomach limits not distinct. The intestine forms an open loop ending in a long rectum attached to the branchial sac. The anus has two smooth lobes.

Of the gonads, only the testis is well developed (fig. 4, D, E). It consist of finger-like lobes located on both sides of the digestive tract, expanding on its wall. The central ovary contains few oocytes. The sperm duct opens in a single papilla against the anus. We have not seen the oviduct.

#### REMARKS

This species is the first recorded antarctic *Adagnesia* species, but three species are recorded from the subantarctic area :

— *Adagnesia henriquei* Monniot and Monniot, 1983, from the Magellanic region, has a similar musculature but with more numerous fibers (85) not extended beyond the middle of the body. The peripharyngeal groove makes a deep V. The branchial sac possesses 35 infundibula rows, equal in size. The gut forms a loop. The genital papillae do not reach the anus.

— *Adagnesia antarctica* Kott, 1969, from Macquarie Island (1.5 cm), has six double infundibula rows and less papillae than infundibula.

— *Adagnesia antarctica* Millar, 1982, from the Chatham Islands, is somewhat larger (2 cm), weakly muscularized and without transverse fibers; the branchial sac has 16 infundibula rows separated by transverse vessels. It cannot be KOTT's *A. antarctica* and MILLAR himself was doubtful about this identification.

#### *Caenagnesia bocki* (Ärnböck, 1938)

MATERIAL : Halley Bay Iransect, st. 226, 229 and 241.

Limited to the antarctic continental shelf, this species is very abundant at several stations. Its external shape, with a groove between the apertures, is characteristic.

***Ascidia challengeri* Herdman, 1882**

MATERIAL : Halley Bay transect, st. 226, 230, 235, 241, 245, 248, 249 and 258 ; Vestkapp area, st. 269, 271, 272 and 273 ; Kapp Norvegia transect, st. 224, 275, 284, 289, 290 and 291.

*A. challengeri* is probably the only antarctic species in the genus. Its distribution is wide : Tasmania, New Zealand, Kerguelen. TURON (1988) has described as *A. challengeri* a species which does not correspond at all to the other specimens of the species.

***Cibacapsa gulosa* Monniot and Monniot, 1983**

MATERIAL : Halley Bay transect, st. 261 BPN 6, 74°36.5'S-29°35.5'W, 798-810 m : 1 specimen.

The EPOS specimen is the fourth recorded. The type specimen was collected in the Ross Sea, two others were collected from the R.V. "Marion-Dufresne" south of Kerguelen, along the Antarctic Continent. Therefore the species distribution is periantarctic.

The previous specimens were firmly attached to pebbles by their posterior side. The test of the EPOS specimen carries some mollusc eggs on the cap. Some soft foraminifera are more or less embedded into the test of the inferior lip. This lip also has some soft papillae which do not contain body wall extensions.

The anatomy of this specimen perfectly corresponds to the original description, but some additional details can be given. The inferior lip carries a diagonal structure that we figured in 1983 but did not interpret. It consists of two parallel internal crests issuing from the right angle of the mouth, joined in the middle of the inferior lip to make a blind end. This structure may represent the remains of an endostyle.

The sinuous organ located on the left side of the cloacal cavity is clearly seen. It is placed under a small lobe on the left side of the mouth. It has not been possible to demonstrate a communication at this level, despite the injection of stain into the cloacal cavity.

The stomach of the type specimen contained Serolidae isopods only. The EPOS animal has ingested crustaceans, of which leg articles remain in the gut and a large Polynoidae polychaete, 5 cm long, partly digested but still recognizable by its scales. The gut contents are embedded in a thick peritrophic membrane. The macrophagous diet of *Cibacapsa gulosa* is confirmed, but it is more diversified than previously asserted, when the hypothesis of an adaptation to the capture of Serolidae isopods was proposed.

***Bathystyloides enderbyanus* (Michaelsen, 1904)**

MATERIAL : Halley Bay transect, st. 252, 1150-1223 m ; Kapp Norvegia transect, st. 295, 2025 m.

The species distribution is wide : around the Antarctic Continent, in the whole Atlantic and Indian Oceans, in abyssal depths between 2500 m and 5000 m. The specimens from the Weddell Sea, collected at 1150 m, are mature and all have the specific characteristics. They significantly extend the known bathymetric distribution of the species.



*Dicarpa insinuosa* (Sluiter, 1912)

MATERIAL : 47°W transect, Signy Island, st. 217; Halley Bay transect, st. 235.

This species is known only from Wilkes Land to the Antarctic Peninsula and South Georgia.

*Dicarpa tricostata* (Millar, 1960)

MATERIAL : Halley Bay transect, st. 226, and 241.

The description of the species was based on one specimen only, devoid of the left gonad. We collected 17 individuals in the Ross Sea, having a gonad on each side. All specimens in the EPOS collection have two gonads of a characteristic structure.

*Cnemidocarpa eposi* n. sp.

(Fig. 5)

MATERIAL : Halley Bay transect, st. 229 AGT 4, 75°15.7'S-26°16.7'W, 498 m : 2 specimens. Holotype : MNHN S1 CNE 163.

The largest specimen, chosen as the holotype, measures 3.5 × 3 cm, but its peduncle is broken. The paratype, smaller, measures 2.5 × 1.8 mm for the part containing the branchial sac, with a peduncle 3 cm long and 0.7 cm in diameter, ending in a tuft of hairs agglomerating sediment particles. The apertures, not protruding, are close to each other and open at the opposite end to the peduncle. The test is naked, smooth and translucent. Its external layer is firm, but interiorly the test is soft and not well separated from the body wall.

The body wall is transparent, revealing the gut and gonads (fig. 5, A, B). The muscles are strong, made of about 35 longitudinal, parallel strips, originating from the siphons. Inside the peduncle, the fibers are no longer in strips but are regularly spaced to form a continuous sheet reaching the posterior end of the peduncle. The transverse fibers are thinner and regularly spaced on the body wall, making a continuous layer into the peduncle.

There are 35 oral tentacles in three or four orders of size, placed around a muscular ring. These tentacles are rather short and soft. The peripharyngeal groove has a high crest dorsally indented in a V. The ciliated tubercle is large, protruding, anteriorly opened in a C-shape with the extremities rolled interiorly. The dorsal lamina is high in its posterior part, with a thin irregular margin.

The branchial sac has four high folds :

R.E.2 14 4 16 4 15 4 10 0 D.L. 0 14 3 16 3 14 4 14 2 E. L.

The first fold on the right side is lower than the others and far from the dorsal lamina. We counted 30 to 50 stigmata between the dorsal lamina and the first longitudinal vessel of the

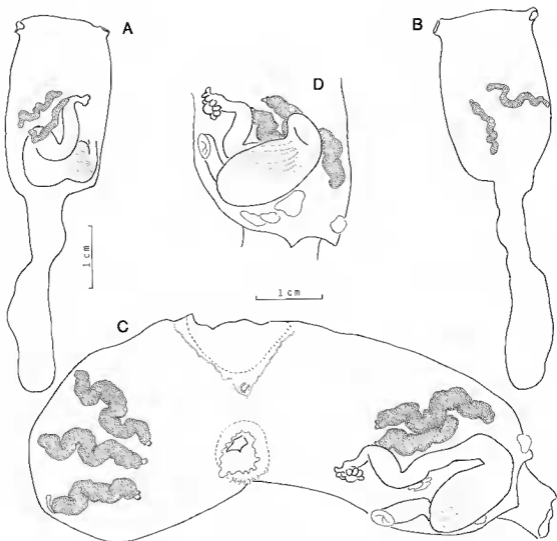


FIG. 5. — *Cnemidocarpa eposi* n. sp. : A and B, left and right sides of the paratype ; C, holotype cut along the ventral line with the gut displaced ; D, gut in normal position.

fold. On the left side, the first fold is normally high and close to the dorsal lamina. The folds are asymmetrical : the vessels located between the folds and those on the ventral side of the folds are at least three times higher than those on the dorsal side. There are fewer ventral than dorsal longitudinal vessels. We counted 25 stigmata in a mesh between the folds, and at least four on the fold. The stigmata are long, narrow and regular. They are cut by a high parastigmatic vessel, sometimes flanked by two thinner vessels.

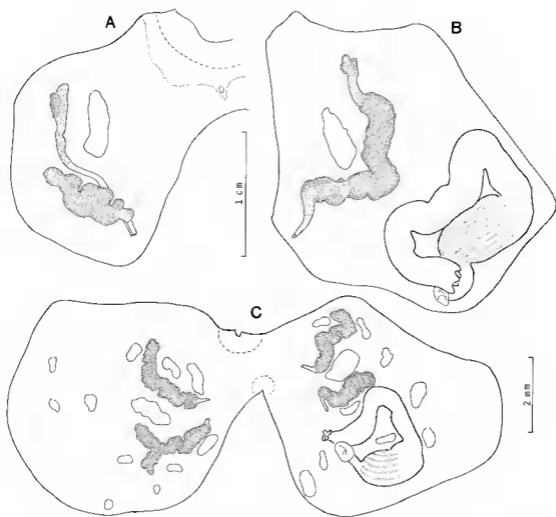


FIG. 6. — A and B, left and right sides of *Cnemidocarpa* sp. 1; C, *Cnemidocarpa* sp. 2 cut along the ventral line.

The gut is posterior. It is attached to the body wall only at the level of the esophagus and rectum (fig. 5, C,D). The esophagus is long, the stomach dilated and flaccid, with a thin wall through which internal grooves are hardly visible. There is no caecum. The stomach changes progressively into a thin walled intestine. The anus has foliated lobes.

The type specimen has three gonads on the right side and two on the left side (fig. 5, C). The paratype has two gonads on each side with the male part not well developed. The gonads are tubular, sinuous with mixed male and female elements. The sperm duct runs along the internal side, receiving numerous spermatic ducts. The male papilla is short, independant of the female papilla. The gonads are protruding but attached to the body wall along their whole length.

There are endocarps between the two branches of the gut and near the peduncle under the stomach. The peduncle is filled with mesenchymatic tissue. Each siphon has a scalloped velum. At the basis of the cloacal siphon some thread-like tentacles are inserted on the posterior part only.

#### REMARKS

The genus *Cnemidocarpa* is very diversified in the subantarctic and antarctic areas. Four species inhabit the continental shelf : *C. pfefferi*, *C. verrucosa*, *C. barbata* and *C. drygalskii*, the latter two having only one gonad on each side.

In 1983, we identified as *Cnemidocarpa* sp. some peduncled specimens collected from the Ross Sea which did not correspond to the four antarctic *Cnemidocarpa*. These specimens were too damaged to be named and described. We have reexamined and figured them : first specimen from 73°05'S-173°59'E, 340 m (fig. 6, A,B) ; second specimen from 73°20'S-170°25'E, 580 m (fig. 6, C). They probably belong to two different species. Both differ from *C. eposi* by their branchial sac (the four folds are separated by numerous longitudinal vessels with at most five stigmata in a mesh), and the presence of endocarps near the gonads.

Some other *Cnemidocarpa* possessing one or two gonads on each side were briefly described. They are :

— *Styela subpinguis* Herdman, 1923, from Adelie Land, figured with a long gut, a bifid gonad ramified on each side and endocarps scattered on the body wall. It may be a specimen of *C. pfefferi*.

— *Styela papillata* Kott, 1954 (non *Styela papillata* Sluiter, 1885) not figured but described from MacRobertson and Kemp Lands, which has tubular gonads (one simple on the left and one bifid on the right side). The species is slightly peduncled. KOTT (1969) synonymized without explanation this species with *Styela nordenskjoldi* sensu Kott. For MONNIOT and MONNIOT (1983) this *S. nordenskjoldi* is *Cnemidocarpa drygalskii*. In our opinion, the synonymy proposed by KOTT cannot be retained, *C. drygalskii* is always settled and hemispherical. It may be possible that our specimen 1 figured (fig. 6 A-B) belongs to this species.

#### *Cnemidocarpa pfefferi* (Michaelsen, 1898)

MATERIAL : Halley Bay transect, st. 226, 229, 235, 241, 245, 248, 258 and 260 ; Kapp Norvegia transect, st. 224.

This periantarctic species is well defined by the peculiar shape of its gonads figured by MILLAR (1960).

#### *Cnemidocarpa verrucosa* (Lesson, 1830)

MATERIAL : Halley Bay transect, st. 226, 245, 248, 249 and 258 ; Vestkapp area, st. 270, 271 and 273 ; Kapp Norvegia transect, st. 224, 284, 290, 291 and 293.

This species is the largest and the most abundant Styelidae in the Antarctic Ocean. Its diameter may reach 20 cm. The test, covered with pointed papillae which are more developed in young specimens and reduced in adults, is very characteristic.

**Styela glans** Herdman, 1881

MATERIAL : Halley Bay transect, st. 245 and 248 ; Kapp Norvegia transect, st. 224, 291 and 293.

This species has been recorded from several stations. It is always small. The type specimen was collected off Río de La Plata at 1000 m depth. In subantarctic areas, it occurs in shallower depths, up to 60 m in the Ross Sea.

**Styela squamosa** Herman, 1881

MATERIAL : Spiess sea-mount, st. 312 AGT 28, 54°43.7'S-0°04.7'E, 320-466m : 1 specimen.

There is only one specimen belonging to this species in the present collection. The species commonly inhabits the continental slope, with specimens collected on the shelf generally showing some abnormalities, but this is not the case here.

**Bathypora splendens** Michaelsen, 1904

MATERIAL : Halley Bay transect, st. 235, 248, 249, 258 and 261 ; Vestkapp area, st. 269, 271 and 273 ; Kapp Norvegia transect, st. 289 and 293.

This collection comprises remarkable specimens of this species which reaches 10 cm in diameter. It is eurybathic, having been recorded from the antarctic continental shelf and slope from 50 to 4636 m depths. It has never been recorded from the periantarctic abyssal bottoms.

The world distribution of the species belonging to this genus is paradoxical. *B. ovoida* (Ritter, 1907) recorded on the California slope and in the rift valley of the eastern Pacific was recently found off Japan. A rare infralittoral species, *B. goreaui*, is described from the West Indies by MILLAR and GOODBODY, 1974.

**Pyura bouvetensis** (Michaelsen, 1904)

MATERIAL : Elephant Island, st. 211 ; 47°W transect, Signy Island, st. 217 ; Halley Bay transect, st. 226, 229, 241, 249, 250, 252 and 261 ; Kapp Norvegia transect, st. 275, 281 and 282.

This pedunculated species has a periantarctic distribution but also lives near Bouvet Island; it does not extend beyond the South Orkney Islands in the Scotia ridge. In South Georgia it is replaced by a closely allied species *P. georgiana*.

***Pyura discoveryi* (Herdman, 1910)**

MATERIAL : 47°W transect, Signy Island, st. 217; Halley Bay transect, st. 226, 229, 230, 235, 241, 245, 248, 249, 258, 259 and 260; Vestkapp area, st. 269, 270, 271, 272 and 273; Kapp Norvegia transect, st. 224, 274, 275, 281, 282, 290, 291 and 293.

The northern limit of this periantarctic species is South Georgia.

***Pyura squamata* Hartmeyer, 1909**

MATERIAL : Kapp Norvegia transect, st. 295, 71°08.8'S-13°48.1'W, 2025-2037 m : 1 specimen.

The habitus of this rare species is characteristic, the animal being flattened on the substrate to which it is attached by the whole ventral side. *P. squamata* was recorded from the Ross Sea, along the coast of Wilhelm II Land and along the South Orkney slope. An empty test, probably belonging to this species, was collected at Kerguelen Islands. This deep species was not previously known below 1250 m.

***Molgula euplicata* Herdman, 1923**

MATERIAL : Halley Bay transect, st. 252; Kapp Norvegia transect, st. 291 : 2 specimens.

Two adult specimens of medium size (2.5 and 3 cm) are present in this collection. We also place in the species a young specimen of 6 mm in diameter, showing traces of gonads around the kidney and only six branchial folds. The gut is on the right side, the kidney on the left side. This is only the second example of *situs inversus* that we have encountered. The other is a specimen of *Polycarpa pusilla* Herdman, 1884 collected in the Bay of Biscay (MONNIOT and MONNIOT, 1985).

***Molgula hodgsoni* Herdman, 1910**

MATERIAL : Halley Bay transect, st. 226, 230, 235, 245, 248 and 258; Vestkapp area, st., 270 and 271; Kapp Norvegia transect, st. 281, 284, 290 and 291.

The distribution of this small periantarctic species extends to South Georgia. The specimens have often been confused with young of *M. pedunculata*.

***Molgula pedunculata* Herdman, 1881**

MATERIAL : Elephant Island, st. 212 ; Halley Bay transect, st. 235, 241 and 252 ; Vestkapp area, st. 271 and 273.

This *Molgula* is the largest species of the genus in the Antarctic ; it may reach 10 cm in diameter for the body and 20 to 30 cm in length for the peduncle. Only one large specimen was collected ; most of the other specimens measure several centimetres, but are juvenile with only the beginnings of gonads.

***Molgula robini* Monniot and Monniot, 1983**

SYNONYMY

*Molgula setigera georgiana* Millar, 1960 : 134 fig. 58 A-D.

MATERIAL : Halley Bay transect, st. 248.

Described from South Georgia, this species was recorded along the Antarctic peninsula and in the Ross Sea. It is characteristic, with long stiff hairs around the apertures. Two other species, with the same habitus, live in the antarctic region : *M. setigera* in the Magellanian area and *M. marioni* from the Kerguelen, Crozet and Marion archipelagos.

***Molguloides coronatum* Monniot, 1978**

MATERIAL : Kapp Norvegia transect, st. 275, 290 and 291.

This is the first record of a *Molguloides* species from a relatively shallow depth (500 m) on the antarctic shelf. Several other species inhabit the slope and periantarctic plains down to 2000 m depth. *M. coronatum* with a gonad of characteristic shape, was previously known only around the Kerguelen Islands. One of the specimens has an abnormal branchial sac with irregular perforations. The first longitudinal vessel, isolated on the right side close to the dorsal lamina, is absent here, whereas, in other species of the genus, it covers an infundibula row.

***Eugyrioides polyducta* Monniot and Monniot, 1983**

MATERIAL : Halley Bay transect, st. 226 and 241.

This species was recorded only from the South Shetland Islands, South Georgia and perhaps Peter I Island. The shape of the oviducts is very peculiar.

**Pareugyrioides arnbackae** (Millar, 1960)

MATERIAL : Halley Bay transect, st. 245 and 252 ; Kapp Norvegia transect, st. 292 and 293.

This small pedunculate species lives in South Georgia and all around the Antarctic. It may be encountered down to 1000 m depth.

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